Biology
Curriculum Framework

Mapping High School Biology to:
Science Cognitive Demands
Texas State Standards: Texas Essential Knowledge and Skills, TEKS
Underlying Processes in TEKS assessed in
Texas Assessment of Knowledge and Skills, TAKS
National Science Education Standards

The El Paso Collaborative for Academic Excellence

Curriculum Framework for High School Biology

A K-16 group of classroom science and biology teachers, faculty, curriculum specialists, and department chairs met over the course of a year and developed a curriculum framework for high school Biology, an important step in developing explicit and comprehensive goals for teachers in El Paso area schools. The framework is a product of collective work of K-16 classroom teachers and faculty from K-12 schools, El Paso Community College, and the University of Texas at El Paso. It is meant to assist science teachers in ensuring that current high school courses are aligned with first year college science courses entering college freshmen will take. Biology is the most recent course in the science alignment process. In previous years, the group developed frameworks for Chemistry, Physics and K-8 Science. The expectation is that as teachers use the framework to provide challenging courses and curriculum in science, the number of students who successfully enroll in and complete college level science courses will increase. Students will benefit because of the collective effort of K-16 teachers who will embrace the next state in this process: implementation with the goal of providing practical revision. With participation from every high school biology teacher, the framework will become the standard in science coursework for every student in El Paso.

Background

In 1998, the El Paso Collaborative Board identified as its top priorities: 1) continuing to focus on mathematics and 2) the alignment of the mathematics curriculum. A review of local data on mathematics achievement showed larger numbers of students enrolled in and completing college preparatory mathematics course in high school. It also revealed a continuous increase in student achievement on TAAS. This high student achievement however, did not reflect student readiness for college mathematics courses. Gaps also existed in high school science preparation for entering college freshmen. Further review of data revealed that large numbers of high school students were placing and enrolling in remedial courses as well as large numbers of students not succeeding in the freshman science courses at El Paso Community College and the University of Texas at El Paso. While many factors contribute to these large numbers, one known factor is that there was little alignment between what high school teachers expect students to know and be able to do, and the expectations of college and university faculty.

To deal with some of these issues, the Mathematics and Science Partnership, MSP, proposed and was funded to continue supporting alignment of mathematics curriculum, assessment, and instruction and to initiate alignment of science K-16. Included in MSP's goals and objectives is to provide students with challenging courses and curriculum in high school mathematics and science courses that prepare them to enroll in and successfully complete college level mathematics and science courses.

Working Group

Starting in Fall 2003, MSP convened a working group of classroom teachers to write curriculum frameworks for Chemistry, Physics, Biology and K-8 Science for teachers to use as curriculum guides no matter what instructional materials they were using for the course. The Working Group included: K-12 classroom teachers from both urban and rural independent school districts; mathematics and science staff developers, specialists in science from both rural and urban school districts; science faculty from El Paso Community College; and faculty representing the Colleges of Education and Science from the University of Texas at El Paso. A complete list of the participants in the K-16 Science Working Group is attached.

To prepare for writing curriculum frameworks for K-8 and high school science courses, the Group engaged in dialogue and discussion focused on science teaching and learning. Using whole and small group formatted discussions, the K-16 Science Working Group:

- analyzed and discussed student performance in science using data collected from state mandated assessments and performance in college freshman courses;

- examined textbooks, course requirements, outline format, state and national placement tools used to assess student readiness for college;
- reviewed the Texas Essential Knowledge and Skills (TEKS), National Science Education Standards, and Atlas of Science Project 2061;
- discussed how concepts were connected and developed in grade levels and how they led to concepts incorporating higher cognitive demands in science;
- identified alternate methods of assessing student learning that provide for standards-based assessment;
- discussed models of teaching science; and
- reviewed and discussed science education literature.

Meeting bimonthly during the 2003 – 2006 academic years and for several days each summer, the Group wrote curriculum frameworks for Chemistry, Physics, K-8 Science, and Biology. Content for the course was placed in text outline form as well as matrix form to map knowledge and skills to cognitive demands as well as to state (TEKS) and national science standards.

K-16 Leaders Group

A leaders group of district leaders and central office personnel from both urban and rural independent school districts and the Education Service Center for Region 19, the provost of the University, science and education deans and mathematics and science department chairs from both the Community College and University, and lead principals and teachers from school districts, was also convened. As an advisory group they discussed and engaged in focused dialogue around issues in mathematics and science education and provided guidance and feedback in the development of the K-16 Mathematics and Science frameworks.

Needs

What we need now is assistance from high school principals and teachers to review, revise, and make practical use of the framework during the academic year. The biology curriculum framework should be reviewed by *every* biology teacher, and, if possible, by all high school science teachers to help prioritize aligning K-16 science curriculum, instruction, and assessment. In order to continue this work, we need participation from every science department in every high school in both urban and rural independent school districts and by secondary biology faculty and chairs.

Call 747-5778 for more information on how you can be involved in reviewing and revising these frameworks.

Lucy H. Michal
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El Paso Collaborative for Academic Excellence

K-16 SCIENCE ALIGNMENT WORKING GROUP

Maria Luisa Arroyo	SISD	El Dorado HS	2004 – present
Socorro Arteaga, Ph. D.	EPCC	Chemistry	2003 – present
Karen Blaine	Region 19	MSP Staff Dev	2004 – 2005
Sally Blake, Ph. D.	UTEP	Science Education	2003 – 2006
Amy Canales	SISD	Science Specialist ES	2003 – present
Evangelina Cantu	SISD	Science Specialist HS	2004 – present
Deborah Caskey	EPCC	Geology	2004 – present
William Cornell, Ph. D.	UTEP	Geology	2005 – present
Karen Davis	Region 19	MSP Staff Dev	2003 – 2004
Olga Deslongchamps	YISD	Parkland HS	2003 – present
Sylvia Esparza	SISD	Socorro HS	2003 – 2005
Maritza Fernandez	YISD	Hacienda Heights ES	2004 – 2005
Sandy Garza	SISD	Science Specialist ES	2003 – 2004
Jeannie Geske	EPISD	Bond ES	2003 – present
Kristin Gosselink, Ph. D.	UTEP	Biology	2005 – present
Eric Hagedorn, Ed. D.	UTEP	Physics	2003 – 2005
Kastro M. Hamed, Ph. D	UTEP	Physics	2003 – 04, 06 – present
Terry Jimarez	UTEP	College of Science	2003 – 2004
Kathy Kraften	EPISD	MSP Staff Dev	2003 – present
Richard Langford, Ph. D.	UTEP	Geology	2005 – present
Carl Lieb, Ph. D.	UTEP	Biology	2004 – present
Mary Liggett	SISD	Socorro MS	2003 – 2005
Jorge Lopez, Ph. D.	UTEP	Physics	2004
Victor Macias	SISD	El Dorado HS	2003 – Aug. 2004
Jose Maldonado	EPCC	Biology	2003 – present
Michael Martin	SISD	Bill Sybert K-8	2006
Nancy Marcus, Ph. D.	UTEP	Mathematics	2003
Emil Michal	EPCC	Physics	2003 – present
Diana Noriega	YISD	Cadwallader ES	2003 – present
Gloria Ontiveros	YISD	Ranchland Hills MS	2003 – present
Myriam Sanchez	SISD	Sambrano ES	2003 – 2005
Luis Saez, Ph. D.	UTEP	Physics	2004
Cynthia Stone	SISD	Science Specialist ES	2003 – 2004
Virginia Tovar	EPISD	Jefferson HS	2003 – 2004
Enrique Villalobos	SISD	MSP Staff Dev	2003 – 2005
Diane Walker	YISD	MSP Staff Dev	2003 – present

Lucy Hernandez Michal lmichal@utep.edu	K-16 Alignment Director and MSP Director of Mathematics and Science	2000 - present

BIOLOGY COURSE OUTLINE

I. COURSE DESCRIPTION

Biology is the study of living things. The course will provide a foundation for understanding living systems and how they function. You will study major life processes at several levels from molecules to ecosystems and how they are interrelated. In addition, the integration of biology to other sciences and its use in making informed decisions about every day life will be covered. Major concepts you will study include evolution, genetics, classification of organisms, energy transfer, cellular structure, and the function of maintaining homeostasis. Field and laboratory investigations will be an integral part of your biology experience. This course will prepare you for a freshman college course in biology.

II. PREREQUISITE KNOWLEDGE

Students entering high school biology should have a middle school level of understanding of**:**

A. Basic academic skills, reading, writing, mathematics, following directions, and problem solving
B. The scientific method
C. Evolution, Mendelian genetics, cell structure and processes/photosynthesis
D. Tools of science (measuring, etc.)
E. Principles of classification

III. CONTENT

Upon completion of high school biology, students should understand and be able to use:

A. The scientific method including knowing how to ask testable questions
B. Energy production/utilization and waste elimination
C. Organization of living systems/ecosystems
D. Principles of classification/taxonomy
E. Interaction between chemical, cellular, and organismal systems
F. Integration of biology, chemistry, and physics in nature
G. Scientific observations and know the difference between casual observations versus observations from scientific inquiry
H. Biology concepts and ideas to:
    1. Apply concepts across systems (reproduction, respiration, homeostasis)
    2. Apply biological principles to everyday experiences
    3. Understand the environment enough to become part of the solution and not part of the problem on our planet.

IV. ASSESSMENT

A. It is suggested that a variety of methods be used to assess student learning. This includes assessments that are formative and summative and include elements that show student growth over time. A variety of activities can be used to identify preconceptions. The teacher should try to incorporate assessments that show student work as well as student explanations of their work. These assessments may include methods such as:
    1. Performance-based assessments including laboratory investigations
    2. Open book (including homework)

3. Technology-based presentations
4. Interviews
5. Observations
6. Projects
7. Portfolios
8. Projects with rubrics (individual and group)
9. Multiple choice
10. Open response
11. Comprehensive, multi-step problems
12. Final comprehensive exam

B. Recommended Course Grade – Each district has guidelines for course grades and, whenever possible, it is recommended that the final course grade for students be determined by a combination of the following:
   1. 25% from formative assessments (daily tools such as warm-ups, quizzes, teacher observations and interviews, group work)
   2. 35% from closed book assessments (constructed response, multiple choice, quantitative comparisons, SAT problems, multi-step problems)
   3. 25% from open book assessments (homework, projects, presentations, portfolios)
   4. 15% from a Final Comprehensive Exam

V. TIMELINE

A brief overview of everyday applications of biology principles may be given during the first week of the semester. It is recommended that the rest of the time be allotted to cover course content and that any further review be embedded in the following units as needed. If a district or school does not have an agreed upon timeline, teachers should convene to agree on a recommended sequence and distribution of time allotted to cover the following units appropriately.

A. Biochemistry (c9A - C)
B. Cellular structure (c5A, c4A-C)
C. Energy (c9B, c9D, c4B, c12A)
D. Genetics (c6A – F)
E. Evolution (c7A – B, c12C)
F. Classification of organisms (c8A – C, c10C)
G. Ecosystems (c9D, c11D, c12A – E, c13A – B)
H. Homeostatic Systems (c4D, c5B – C, c10A – C, c11A – D)

VI. INFORMATION/RESOURCES REQUIRED FOR STUDENTS

A. Course description
B. Teacher information (conference period, office hours)
C. Work, projects, homework, exams, grading policy for each
D. Rubrics for projects/presentations/portfolios
E. Resources – tutoring, lab, Internet websites specific to the course, computer programs, teacher conference period, other outside support available
F. Weekly calendar
G. Textbook, calculator
H. Lab materials

VII. MATRIX MAPPING TOPICS TO COGNITIVE DEMANDS

A. Attached is a matrix that maps knowledge and skills to cognitive demands.
The work on cognitive demands has been guided by work of Andrew Porter, Norman Webb, and John Smithson. The cognitive demands identified by Porter, Webb, and Smithson were used as models and modified by the K-16 Science working group to fit their work in high school science courses. These identify thinking levels that incorporate five (5) levels of cognitive demands. They are listed on the matrix from higher order to lower order as you read from left to right. The matrix also maps content to state standards and, for some courses, frameworks also map textbooks and materials used in major independent school districts. The K-16 Science Working Group produced the matrix to provide guidance for teachers in planning instruction and designing assessment for the course.

B. Cognitive Demands for Science
Cognitive demands assist teachers in distinguishing what students are expected to know and be able to do with science content, and what level of thinking students must be engaged in while learning content. This mapping of topics to cognitive demands describes content knowledge that will not merely be stored, but also understood, represented, organized, connected, and structured in ways that facilitate retrieval and application of knowledge. By mapping knowledge and content to cognitive demands, teachers engage students in using, representing and connecting pieces of content knowledge in coherent ways that will determine whether students understand knowledge deeply and can use it to solve new problems. They are:

1. **Analyze Information** – classify and compare data, analyze data, recognize patterns, reason inductively or deductively, draw conclusions, identify faulty arguments or misrepresentations of data, spatial reasoning

2. **Apply Concepts/Make Connections** – apply and adapt science information to real-world situations, apply science ideas outside the context of science, build or revise theory, plan and design experiments, synthesize content and ideas from several sources, use and integrate science concepts

3. **Understand Concepts** – explain concepts, observe and explain teacher/student demonstrations, explain procedures and methods of science inquiry, organize and display data in tables or charts, present science information, construct or use models to represent science ideas

4. **Perform Procedures/Conduct Investigations** – make observations, collect and record data, use appropriate tools make measurements, do computations, organize and display data in tables or charts, execute procedures, generate questions, make predictions, conduct experiments, test effects of different variables, select and use appropriate tools.

5. **Memorize Facts, Definitions, Formulas** – recite basic science facts, recall science terms and definitions, recall scientific formulas

C. Matrix Format and Its Use as A Teaching and Learning Tool

1. Strands and topics in matrices overlap and may be integrated
2. Cognitive demands overlap and are neither linear nor sequential.
3. TEKS are categorized in 4 strands
   a. Nature of science (TEKS c1 – c3) embedded in all strands
   b. Properties, Patterns, and Models (TEKS c4, c5, c13)
   c. Constancy and change (TEKS c6 – c8)
   d. Systems (TEKS c9 – c12)
4. Items in the matrix appearing in regular fonts are actual TEKS and are placed within a suggested cognitive demand.
5. Italicized items support teaching and learning at a higher level of cognitive demand to reach conceptual understanding of a topic or concept and are meant to support the learning of TEKS with understanding. Paraphrased TEKS are also italicized where they address different cognitive demands or reference TEKS under multiple cognitive demands.

D. Vocabulary

Key terms are **bolded** in the TEKS within the curriculum framework matrix. These terms represent essential concepts in biology that require a deep understanding beyond memorization. During instruction, it is important that both teachers and students use these and other appropriate terms within the conceptual framework of the course. In this way, students learn to incorporate relevant terms, express their thinking and knowledge using scientific language, and use terms in context.

Biology Curriculum Framework Mapping Knowledge and Skills to Cognitive Demands

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Nature of Science The student: c1 for at least 40% of the time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. c2. uses scientific methods during field and laboratory investigations. c3. uses critical thinking and scientific problem solving to make informed decisions.	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
	c1B. Make wise choices in the use and conservation of resources and the disposal or recycling of materials *c2C. Organize, analyze, and evaluate trends from data* *c3A. Analyze and review scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information* c3B. Evaluate promotional claims that relate to biological issues such as product labeling and advertisements c3E. Evaluate models according to their adequacy in representing biological objects or events	c2C. Make inference and predict trends from data *c2A. Plan investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology* *c3A. Critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information* c3C. Evaluate the impact of research on scientific thought, society and the environment c3D. Describe the connection between biology and future careers	c1A. Demonstrate safe practices during field and laboratory investigations c2D. Communicate valid conclusions	c2A. Implement investigative procedures including asking questions and selecting equipment and technology c2B. Collect data and take measurements c3F. Research and describe the history of biology and contributions of scientists	

Textbook and Materials	**National Science Education Standards**
	9-12 Life Science: The Cell 9-12 Science and Personal & Social Perspectives: Personal and Community Health 9-12 Unifying Concepts & Processes: Systems Form & Function Evolution and Equilibrium 9-12 Science as Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Properties, Patterns, and Models c4. The student knows that **cells** are the basic structures of all living things and have specialized parts that perform specific functions and that **viruses** are different from **cells** and have different properties and functions	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
		c4C. Compare the structures and functions of **viruses** to **cells** and describe the role of viruses in causing diseases such as acquired immune deficiency syndrome, common colds, smallpox, influenza, and warts c4D. Identify and describe the role of **bacteria** in maintaining health such as in digestion and in causing diseases such as in streptococcus infections and diphtheria	*c4B. Identify cellular processes including **homeostasis**, **permeability**, energy production, transportation of molecules, disposal of wastes, function of cellular parts, and synthesis of new molecules*	*c4B. Investigate cellular processes including **homeostasis**, **permeability**, energy production, transportation of molecules, disposal of wastes, function of cellular parts, and synthesis of new molecules*	c4A. Identify the parts of **prokaryotic** and **eukaryotic** cells

Textbook and Materials	National Science Education Standards
	9-12 Life Science: The Cell 9-12 Science and Personal & Social Perspectives: Personal and Community Health 9-12 Unifying Concepts & Processes: Systems Form & Function Evolution and Equilibrium 9-12 Science as Inquiry: Ability Necessary to do Scientific Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Properties, Patterns, and Models c5. The student knows how an **organism** grows and how specialized **cells, tissues**, and **organs** develop.	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
		c5B. Identify **cell differentiation** in the development of **organisms** c5C. Sequence the levels of organization in **multicellular organisms** to relate the parts to each other and to the whole		c5A. Compare **cells** from different parts of plants and animals including **roots, stems, leaves, epithelia, muscles**	Xylem Phloem

Textbook and Materials	National Science Education Standards
	9-12 Life Sciences: The Cell 9-12 Science as Inquiry 9-12 Unifying Concepts & Processes/Form and Function

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Constancy and Change c6. The student knows the structure and functions of **nucleic acids** in the mechanisms of **genetics**.	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
	c6E. Compare the processes of **mitosis** and **meiosis** and their significance to sexual and asexual reproduction c6F. *Analyze **karyotypes***	C6C. *Illustrate how changes in **DNA** cause **mutations** and evaluate the significance of these changes*	c6A. *Illustrate how the information for specifying the **traits** of an organism is carried in the **deoxyribonucleic acid, DNA*** c6B. Explain **replication, transcription,** and **translation** using models of **DNA** and **ribonucleic acid (RNA**) c6C. *Identify how changes in **DNA** cause **mutations** and evaluate the significance of these changes*	c6D. Compare **genetic variations** observed in plants and animals c6F. *Identify **karyotypes***	c6A. *Describe components of **deoxyribonucleic acid, DNA*** Chromosome Protein

Textbook and Materials	National Science Education Standards
	9-12 Life Science: Molecular Basis of Heredity, Biological Evolution 9-12 Science As Inquiry: Ability Necessary to do Scientific Inquiry, Understandings About Scientific Inquiry 9-12 Unifying Concepts and Processes: Evolution and Equilibrium; Form and Function; Evidence, Models and Explanation

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Constancy and Change c7. The student knows the **theory of biological evolution.**	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
	c7B. Illustrate the results of **natural selection** in **speciation, diversity, phylogeny, adaptation, behavior, and extinction**			c7A. Identify evidence of change in **species** using **fossils, DNA sequences**, anatomical similarities, physiological similarities, and **embryology**	Anatomy Physiology

Textbook and Materials	National Science Education Standards
	9-12 Life Science: The Cell 9-12 Science and Personal & Social Perspectives: Personal and Community Health 9-12 Unifying Concepts & Processes: Systems Form & Function Evolution and Equilibrium 9-12 Science as Inquiry: Ability Necessary to do Scientific Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Constancy and Change c8. The student knows applications of **taxonomy** and can identify its limitations.	c2, c3	c2, c3	c1, c2, c3	c1, c2, c3	
	c8B. *Analyze relationships among* ***organisms***	*Explore reasons for constructing the groups*	c8B. *Develop a model of a hierarchical classification system based on similarities and differences using* ***taxonomic nomenclature***	c8A. Collect and classify organisms at several **taxonomic levels** such as **species**, **phylum**, and **kingdom** using **dichotomous keys** c8C. Identify characteristics of **kingdoms** including **monerans, protists, fungi, plants,** and **animals**	Hierarchy

Textbook and Materials	National Science Education Standards
	9-12 Life Science: Biological Evolution 9-12 Unifying Concepts and Processes 9-12 Science as Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Systems c9. The student knows **metabolic processes** and **energy transfers** that occur in living **organisms**.	c2, c3	c2, c3	c1, c3, c3	c1, c2, c3	
	c9C. *Analyze* and identify the effects of **enzymes** on food molecules c9D. Analyze the **flow of matter and energy** through different **trophic levels** and between organisms and the physical environment	c9B. Compare the **energy flow** in **photosynthesis** to the **energy flow** in cellular respiration	c9A. Compare the structures and functions of different types of **biomolecules** such as **carbohydrates, lipids, proteins,** and **nucleic acids** c9B. *Explain and* compare the energy flow in **photosynthesis** to the **energy flow** in **cellular respiration**	c9C. Investigate and identify the effects of **enzymes** on food molecules	Polarity

Textbook and Materials	**National Science Education Standards**
	9-12 Life Sciences: Matter Energy, Organizational in Living Systems 9-12 Unifying Concepts and Processes 9-12 Science as Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Systems c10. The student knows that, at all levels of nature, **living systems** are found within other living systems, each with its own boundary and limits. (*i.e. Understanding biological levels of organization)*	c2, c3	c2, c3	c1, c3, c3	c1, c2, c3	
	c10B. Compare the interrelationships of **organ systems** to each other and to the body as a whole c10C. Analyze and identify characteristics of **plant systems**, *plant structure, plant function*, and subsystems	c10B. Compare the interrelationships of **organ systems** to each other and to the body as a whole	c10A. Explain the functions of systems in organisms including **circulatory, digestive, nervous, endocrine, reproductive, integumentary, skeletal, respiratory, muscular, excretory,** and **immune**		

Textbook and Materials	National Science Education Standards
	9-12 Life Science: Interdependence of Organisms; Matter, Energy, & Organization in Living Systems 9-12 Unifying Concepts and Processes 9-12 Science as Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Constancy and Change c11. The student knows that **organisms** maintain **homeostasis.**	c2, c3	c2, c3	c1, c3, c3	c1, c2, c3	
		c11C. Analyze the importance of **nutrition**, environmental conditions, and physical exercise on health c11D. Summarize the role of **microorganisms** in maintaining and disrupting **equilibrium** including diseases in plants and animals and decay in an **ecosystem**	c11A. Identify and describe the relationships between internal **feedback mechanisms** in the maintenance of **homeostasis**	cllB. Investigate and identify how organisms, including humans, respond to external stimuli	Negative feedback Positive feedback Stimulus

Textbook and Materials	National Science Education Standards
	9-12 Life Science: The Cell, Behavior of Organisms, Behavior of organisms, Interdependence of Organisms 9-12 Unifying Concepts and Processes: Change, Constancy, & Measurement; Evolution and Equilibrium

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Systems c12. The student knows that interdependence and interactions occur within an **ecosystem**.	c2, c3	c2, c3	c1, c3, c3	c1, c2, c3	
	c12A. Analyze the **flow of energy** through various cycles including the carbon, oxygen, nitrogen, and water cycles c12C. Compare *and contrast* variations, tolerances, and adaptations of plants and animals in different **biomes**	c12B Interpret interactions among **organisms** exhibiting **predation, parasitism, commensalism, and mutualism** c12E. Investigate and explain the interactions in an **ecosystem** including food chains, food webs, and food pyramids	c12D. Identify and illustrate that long term survival of species is dependent on a resource base that may be limited c12E. Investigate and explain the interactions in an **ecosystem** including food chains, food webs, and food pyramids		

Textbook and Materials	National Science Education Standards
	9-12 Life Science: Interdependence of Organisms; Matter, Energy, and Organization in Living Systems 9-12 Science in Personal and Social Perspective: Natural Resources 9-12 Unifying Concepts and Processes: Change, Constancy, and Measurement 9-12 Science as Inquiry

Knowledge and Skills	Cognitive Demands				
	Analyze Information	**Apply Concepts/ Make Connections**	**Understand Concepts**	**Perform Procedures**	**Memorize**
Properties, Patterns, and Models c13. The student knows the significance of plants in the environment. *(i.e. structure and function of plants)*	c2, c3	c2, c3	c1, c3, c3	c1, c2, c3	
	c13A. Evaluate the significance of structural and physiological **adaptations** of plants to their environment		c13B. Survey and identify methods of reproduction, growth and **development** of various types of plants		

Textbook and Materials	National Science Education Standards
	9-12 Life Science: Behavior of Organisms, The Cell 9-12 Unifying Concepts & Processes: Behavior of Organisms, The Cell

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